



FY2009: Regional Integrated Ocean Observing System Development

NATIONAL CROSS-CUTTING IOOS DEVELOPMENT

NOAA continued a merit-based funding process in 2009 to enhance regional coastal ocean observing systems (RCOOSs) and achieve three long-term outcomes: establishing coordinated regional observing and data management infrastructures, developing applications and products for regional stakeholders, and crafting regional and national data management and communications protocols. The three projects below represent a broad scope of technical support that provide service to all IOOS regions by contributing fundamental research, analysis, and communications that expand the foundation for a national system. The total FY2009 investment for these projects is \$1,675,800.

Project Title:

Alliance for Coastal Technologies (ACT)

Recipient/ Lead Principal Investigator:

University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory
Dr. Mario Tamburri (tamburri@cbl.umces.edu)

Cost:

Funded: FY 2007 (Year 1) - \$1,100,000
FY 2008 (Year 2) - \$1,200,000
FY 2009 (Year 3) - \$1,200,000

Performance:

The Alliance for Coastal Technologies (ACT) is a NOAA-funded partnership of research institutions, resource managers, and private sector companies dedicated to fostering the development and adoption of effective and reliable sensors and platforms. ACT priorities include: transitioning emerging technologies to operational use rapidly and effectively; maintaining a dialogue among technology users, developers, and providers; identifying technology needs and novel technologies; documenting technology performance and potential, and; providing the Integrated Ocean Observing System (IOOS) with information required for the deployment of reliable and cost-effective networks. To address these priorities, ACT provides three fundamental services: (1) third-party test bed for quantitatively evaluating the performance of new and existing coastal technologies in the laboratory and under diverse environmental conditions; (2) capacity and consensus building through technology specific workshops that review the current state of instrumentation, build consensus on future directions, and enhance communications between users and developers, and; (3) serves as an information clearinghouse through a searchable online database of environmental technologies and community discussion boards.

Schedule:

1. Year 1
 - Support the NOAA National Data Buoy Center and U.S. Army Corps of Engineers in the development of an IOOS Operational Waves Observation Plan
 - Complete the ACT Technology Evaluation of in-situ nutrient analyzers and release Demonstration Statements on individual instrument performance
 - Initiate Technology Verification of in-situ salinity sensors

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- Conduct a Needs and Use Assessment of in-situ salinity sensors and release report
 - Hold a series of technology workshops on topics including in-situ salinity sensors, biological platforms for environmental sensors, and hydrocarbon sensors for oil spills
2. Years 1-3
- Support IOOS Regional Association activities
 - Maintain and expand online, searchable database of environmental technologies and ACT website to provide up-to-date information on activities, products, reports, newsletters, and facilitate information exchange
3. Year 2
- Complete the Technology Evaluation of in-situ salinity sensors and release Verification Statements on individual instrument performance
 - Initiate Technology Demonstrations of in-situ pCO₂ sensors for ocean acidification and Harmful Algae detection technologies/methodologies
 - Conduct Needs and Use Assessments for specific technologies
 - Collaborate with CICEET on a workshop addressing technologies and methodologies for detection of harmful algae and their toxins
 - Facilitate and collaborate in the development of a National High Frequency (HF) Radar Ocean Current Measurement Plan
 - Support IOOS and collaborate with the Marine Metadata Interoperability (MMI) program efforts in instrument interoperability
 - Support Quality Assurance of Real-Time Oceanographic Data (QARTOD) workshop in partnership with the National Data Buoy Center
4. Year 3
- Complete the ACT Technology Evaluations of in-situ pCO₂ sensors and HAB detection technologies/methodologies and release Demonstration Statements on individual instrument performance
 - Initiate new Technology Evaluation based in IOOS and community needs
 - Hold a series of technology workshops on topics including emerging technologies for identifying impacts and extent of climate change on coastal environments
 - Conduct Needs and Use Assessments for specific technology themes
 - Conduct Technology Training Exercises and develop additional Technology Best Practices documents
 - Partner with the National Water Quality Monitoring Network on guides to, and standard operating procedures for, in-situ sensors and in harmonizing databases on environmental technologies and analytical methods.

Project Title:

An OPeNDAP/OGC Gateway to Support Regional IOOS Interoperability

Recipient/ Lead Principle Investigator:

OPeNDAP, Inc./Daniel Holloway (*d.holloway@opendap.org*)

Cost:

Funded: FY 2007 (Year 1) - \$368,116

FY 2008 (Year 2) - \$269,655

FY 2009 (Year 3) - \$269,655

Performance:

Investigators will build OPeNDAP gateways to two Open Geospatial Consortium (OGC) data protocols – Web Coverage Service (WCS) and Web Feature Service (WFS) or Sensor Observation Service (SOS). Two communities of users will be targeted: the Integrated Ecosystem Assessment (IEA) resource manager and resource managers and data providers associated with several of the regional associations (RAs). As with all OPeNDAP software, the resulting source code will be made freely available to the community. Specifically, investigators will address needs of NOAA's IEA program, with IEA managers serving as data users and Pacific Fisheries Environmental Laboratory IEA archive and regional IOOS archives serving as data providers. In addition to collaboration with NOAA's IEA program, investigators will collaborate with participants in two RAs (CenCOOS and MARCOOS) to provide geographic information systems (GIS) access via OGC services to data products from these associations with particular emphasis on HF radar (CODAR)-derived surface current fields. The gateways will be documented and freely available to other regional associations.

Schedule:

1. Year 1
 - Design coverage data interface (using WCS specification)
 - Plan workshop for community feedback on data model issues
 - Design WFS feature data interface (originally proposed using WFS specification, migrating to SOS specification)
 - Develop beta version of the WCS interface, with support for netCDF Climate and Forecast Metadata Conventions (netCDF-CF) Well Known Binaries (WKB) and native IOOS
 - Complete Response Handler for WCS, module for the OPeNDAP Lightweight Front-end Server (OLFS), and Ancillary Information Service (AIS) extensions
 - Write ontology that allows for translation between OPeNDAP/CF and WCS
2. Year 2
 - Formally release the WCS interface
 - Write ontology for translation between OPeNDAP/DAPPER data model and WFS and/or SOS
 - Develop beta version of the WFS (and/or SOS) interface, with support for netCDF-CF: (a) build an extension to the WCS module in the OLFS for WFS (and/or SOS) and (b) develop a XML version of a combined Data Attribute Server (DAS) and Data Descriptor Structure (DDS) (DDX) to Geography Markup Language (GML) Schema module for the Back-End Server (BES)
 - Formally release the WFS and/or SOS interface
 - Provide revised version of WCS gateway
 - Host a server installation and configuration workshop
3. Year 3
 - Add support for Aggregation Response Handler
 - Extend Aggregation Response Handler to work with in-situ data collection
 - Complete all ontologies
 - Provide final version of WCS gateway
 - Provide revised version of WFS and/or SOS gateway
 - Document ontologies and servers
 - Provide final release of WFS and/or SOS gateway

Project Title:

Standards Integration of QA/QC Requirements for Oceanographic Observing Systems

Recipient/ Lead Principal Investigator:

Woods Hole Oceanographic Institution/ Janet Fredericks (*jfredericks@whoi.edu*)

Cost:

Funded: FY 2007 (Year 1) - \$286,087
 FY 2008 (Year 2) - \$206,145
 FY 2009 (Year 3) - \$206,145

Performance:

With support from NOAA, a grass roots organization, Quality Assurance in Real Time Oceanographic Data (QARTOD), has met regularly over the past few years to work towards the definition of minimum requirements in quality assurance/quality control (QA/QC) in four focus areas: waves, in-situ currents, conductivity and temperature, and dissolved oxygen. Investigators will supplement the ongoing QARTOD activities by demonstrating an implementation of the QARTOD results. For each focus area, investigators propose to define and document the QA/QC requirements, as they relate to Open Geospatial Consortium (OGC) standards, in particular the Sensor Web Enablement initiative. With these requirements, the team will prepare a common data model, providing data dictionaries and defining relevant profiles in SensorML. Focus area experts and representatives from data centers will review the data model, dictionaries, and profiles to confirm that a functional and feasible model has been developed. Once the model is finalized, the development team will design any required methods and generate a tutorial for implementation of the Sensor Web Enablement (SWE) standards for the QA/QC of the focus area (e.g., waves). The team will also provide associated XML-generating tools that evolve for the generation of QA/QC templates for each of the focus areas, facilitating implementation by participating data providers.

Local data providers will implement the QA/QC standards, as defined within this project through the OOSTethys Sensor Observations Service (SOS), maintained by the Gulf of Maine Ocean Observing System (GoMOOS) as part of a relatively broad community activity involving the Southeastern Universities Research Association (SURA) and the Marine Metadata Interoperability (MMI) project. Other OOSTethys participants will be informed of the capabilities through the cookbooks and best practices documents being developed on their site (*www.oostethys.org*), and encouraged to participate through travel support requested in this proposal. The deliverables will be made publicly available through the MMI web site (*www.marinemetadata.org*) and open source software implementations and cookbooks through *www.oostethys.org*.

Schedule:

1. Year 1
 - Develop common data model profile for ocean observation data, current observation data, and wave observations data
 - Develop/review/test methods, tools and tutorial on implementing wave data profile
 - Draft and approve specifications for qualifiers, parameters, and methods of QA/QC for wave observations for use in SensorML data model
 - Meet with wave and in-situ current experts/researchers
 - Announce product to the broader community before March 2009

2. Year 2

- Draft/approve specifications for qualifiers, parameters, and methods of QA/QC for current observations for use in SensorML data model
- Develop/review/test methods, tools, and tutorial on implementing the current data profile
- Meet with conductivity, temperature, and depth (CTD) and dissolved oxygen (DO) experts
- Announce product to the broader community before March 2010

3. Year 3

- Develop common data model profile for CTD and DO observation data
 - Draft and approve specifications for qualifiers, parameters, and methods of QA/QC for CTD and DO observation data for use in SensorML data model
 - Meet with subset of oceanographers and OOSTethys representatives and select data providers
 - Develop, review, and test methods, tools, and tutorial on implementing CTD and DO profiles
 - Finalize all tutorials and tools
 - Announce product to the broader community before January 2011
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NOAA IOOS Program Office Contacts:

Gabrielle Canonico (Gabrielle.Canonico@noaa.gov), Regional Coordinator

Regina Evans (Regina.Evans@noaa.gov), Grants Administrator



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ALASKA REGION

The Alaska Region includes the entire state of Alaska. The 2009 RCOOS award to this region is \$1,000,000. The 2009 Regional Association Planning Grant award to this region is \$399,969.

Project Title:

Alaska Regional Coastal and Ocean Observing System 2008-2010

Recipient/ Lead Principal Investigator:

Seward Association for the Advancement of Marine Science on behalf of the Alaska Ocean Observing System/
Molly McCammon (mccammon@aoos.org)

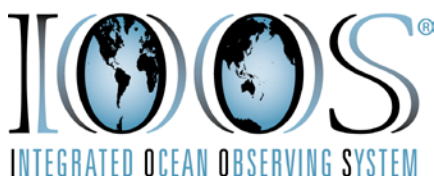
Cost:

Funded: FY 2008 (Year 1 RCOOS) - \$1,000,000
FY 2009 (Year 2 RCOOS) - \$1,000,000
Proposed (subject to available funds): Year 3 - \$3,499,918

Performance:

The Alaska Ocean Observing System (AOOS) is focused on four key issues: climate change and its impacts, sustainability of fisheries and marine ecosystems, mitigation of natural hazards, especially coastal erosion, and safety of marine operations and health of coastal communities. Priorities in FY09 include continued development of the Prince William Sound (PWS) Ocean Observing System pilot project that collects observations for use by stakeholders and develops and tests forecast models as a demonstration of an end-to-end observing system in Alaska. The high-resolution wind, wave, and ocean current forecast products provide improved marine safety for recreational and commercial vessel operators and enhance the security to oil tanker traffic in PWS, and will ultimately be expanded to the northern Gulf of Alaska. In addition, AOOS will work to establish its data and web portal as the regional coastal and ocean information system for Alaska, furthering statewide capacity in data management, modeling, and product visualization.

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Project Highlights:

Year 1

- PWS Demonstration: Additional telemetered moorings deployed to improve ocean observations and model forecasts; boat surveys conducted to calibrate ocean forecast model; first iteration of forecast models tested during major field experiment: July 19 – August 3, 2009
- Data Management: Data portal, data acquisition, archiving, and access expanded. Alaska Marine Information System (AMIS) developed as major data management tool
- Education and Outreach: Engaged stakeholders and customers with focus groups and workshops; revamped AOOS website; collaborated with new Centers for Ocean Sciences Education Excellence (COSEE) Alaska on education and outreach products

Year 2

- Review results of PWS Demo. Identify and develop suite of forecast models for weather, waves, and currents to expand PWS demo system to Cook Inlet/Kenai coast; plan design for Arctic nearshore observing systems
- Data management: Finish AMIS design and begin implementation
- Education and Outreach: Develop and implement key themes and messages, public awareness campaign; use PWS Demo results for educational products

Year 3 Plans (contingent on funding)

- PWS Demonstration: Maintain operational components of PWS observing system
- Data Management: Expand remote sensing capacity; create operational center for regional forecast models
- Southeast Alaska Ocean Circulation Model: Analyze past model data to complete ocean circulation model in Southeast Alaska; deploy two moorings in the southeast to validate models
- Harbor Observing Network Prototype: Test HarborNet prototype in remote Arctic location
- Expand PWS Demo to Cook Inlet/Kenai Coast: Deploy additional telemetered weather stations required to improve weather observations and forecasts in Cook Inlet/Kenai coast; deploy additional telemetered moorings required to improve ocean observations in Cook Inlet/Kenai coast; deploy High Frequency Radar
- Bering Sea/Aleutians Ocean Circulation Models: Deploy four moorings across Amukta Pass; analyze data and incorporate into models
- Passive Acoustic Monitoring in Bering Sea: Deploy three autonomous recorders in eastern Bering Sea; analyze data; prepare paper on findings; develop comprehensive ambient noise monitoring program
- Arctic Monitoring: Develop nearshore climatology with sea ice and fastice atlas; develop nearshore observation system for ice-free season; continue sea ice radar program in Barrow; add additional sea ice radars; improve sea ice forecasts with sea ice thickness measurements
- Education and Outreach: Develop K-12 education guide and products, including educator workshops; hold ocean observing virtual field trip; continue to engage stakeholders and customers with focus groups and workshops

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CARIBBEAN REGION

The Caribbean Region is defined as Puerto Rico, the U.S. Virgin Islands, and the island of Navassa. The 2009 RCOOS award to this region is \$527,016. The 2009 Regional Association Planning Grant award to this region is \$399,826.

Project Title:

Implementation of the Caribbean Regional Integrated Coastal Ocean Observing System

Recipient/ Lead Principal Investigator:

University of Puerto Rico at Mayaguez/ Prof. Julio M. Morell (julio.morell@upr.edu)

Cost:

Funded: FY 2008 (Year 1) - \$499,999

FY 2009 (Year 2) - \$527,016

Proposed (subject to available funds): Year 3 - \$992,735

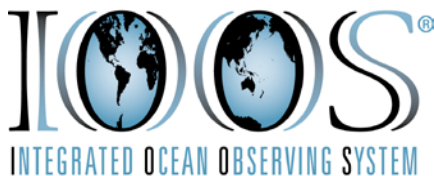
Performance:

This project will continue implementation of a Caribbean Integrated Coastal Ocean Observing System (CarICOOS) consistent with national IOOS development plans. Investigators will address stakeholder needs through 1) enhancement of existing and installation of essential in situ observational assets, 2) operational implementation of modeling tools, validated with the above observations, and 3) partnering with NOAA for the production of regionally focused remote sensing products. Achieving DMAC compliant data processing and archiving, and appropriate data and data product dissemination to agencies and stakeholders will assure initial implementation of a user-responsive, operational Caribbean Integrated Coastal Ocean Observing System.

Schedule:

1. Year 1

- Deploy CarICOOS I buoy and Acoustic Doppler Current Profiler (ADCP) off the south coast of the region and make its currents, wave, sea level, and meteo data available
- Make available Intra-Americas Sea Ocean Nowcast/Forecast System graph products at full resolution
- Develop near coastal data assimilation schemes for use in Advanced Circulation (ADCIRC) model for coastal circulation products and validate initial simulations
- Run Regional Ocean Modeling System (ROMS) hindcast simulations and analyze results
- Complete and distribute tropical storm inundation maps
- Deploy temperature and salinity sensors aboard CarICOOS buoy



- Make available NOAA CoastWatch Caribbean and Gulf of Mexico Node turbidity and Sea Surface Temperature products
2. Year 2
- Install 5 hardened coastal meteorological stations; add telemetry capability to existing meteorological stations; make available data streams and graphical products; provide validated meteorological data to NWS-SJ for incorporation into their forecasting data suite; continue the meteorological station improvement program with WeatherFlow Inc.
 - Provide validated nearshore shallow water wave forecast and nowcast data
 - Include regionally focused remote sensing products in CarICOOS web page
 - Continue delivery of data streams from first CarICOOS buoy
 - Replaced CarICOOS I buoy with CarICOOS II buoy in June 2009
 - After reconditioning, deploy CarICOOS I buoy off the northern coast of the region.
 - Continue consultation regarding products and delivery strategies
 - Continue operational output and publication of wind and wave products
 - Continue development of DMAC and data access products
 - Complete and distribute category one hurricane inundation maps
 - Develop value-added visualization and distribution systems for tourism and marine commerce industries
3. Years 2 – 3 (subject to available funding)
- Continue validations for prototype ADCIRC surface tide and coastal circulation modeling using in situ observations
 - Continue validations for HYbrid Coordinate Ocean Model (HYCOM-ROMS) high resolution prototype western Puerto Rico and Virgin Islands grids using in situ observations
 - Continue calibration/validation for remotely sensed protocols
4. Year 3 (subject to available funding)
- Contract construction of CarICOOS III buoy; acquire observational instrumentation
 - Recycle mooring off the north coast of the CaRA region with CarICOOS III third buoy
 - Integrate and optimize observational and modeling components through data assimilation
 - Identify WeatherFlow meteo station gap
 - Implement operational ADCIRC surface tide and coastal circulation modeling
 - Implement operational HYCOM-ROMS for the high resolution western PR and VI grids
 - Fully implement and publish DMAC and web-based tools and products
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CENTRAL AND NORTHERN CALIFORNIA REGION

The Central and Northern California Region runs from the California/Oregon border south to Point Conception. The 2009 RCOOS award to this region is \$1,281,529, of which \$281,529 is specifically directed to support the operation and maintenance of the region's High-Frequency radar surface current mapping network. The 2009 Regional Association Planning Grant award to this region is \$397,308.

Project Title:

CeNCOOS: Long-term monitoring of environmental conditions in support of protected marine area management in central and northern California

Recipient/ Lead Principal Investigator:

Monterey Bay Aquarium Research Institute/Steven R. Ramp (sramp@mbari.org)

Cost:

Funded: FY 2008 (Year 1) - \$1,000,000
FY 2009 (Year 2) - \$1,281,529
Proposed (subject to available funds): Year 3 - \$3,498,007

Performance:

The project builds upon the Central and Northern Coastal Ocean Observing System (CeNCOOS) in open and semi-enclosed bays, including San Francisco Bay, Monterey Bay, Bodega Bay, Humboldt Bay, and Morro Bay. The focus is on observing temperature, salinity, sea level, currents, and waves, and relating changing conditions to ecosystem and human health. Top priorities include maintaining the pan-regional backbone and developing a Data Management and Communications (DMAC) system to move data seamlessly from the sensor to the product developer, and allow easy access to data and products for all CeNCOOS partners and end users.

Schedule:

1. Year 1
 - Implement CeNCOOS wind product running in real-time 24/7
 - Hire CeNCOOS Chief Product Developer
 - Develop Upwelling Response Index (URI) and Primary Productivity Index (PPI)
 - Hold workshops to design HAB-related products from a combination of remote sensing, pier stations, and in-water assets

2. Years 1-3

- Improve the CeNCOOS wind product, including seamless integration into the new CeNCOOS website and provide more detail with 'zoom boxes'
- Operate and maintain water quality stations, including biological sampling along the north coast
- Operate existing autonomous underwater vehicles
- Operate wharf sampling
- Maintain glider and mooring time series
- Continue building the CeNCOOS DMAC, to include web services and overall system engineering; begin developing the CeNCOOS portal
- Produce user-driven data products for CeNCOOS customers as requested

3. Year 2:

- Refurbish and recalibrate instruments and mooring equipment
- Hire full-time system programmer to assist with data portal implementation and improvements
- Develop educational products using CeNCOOS real-time data streams

2. Years 2-3:

- Add one glider per year to the system to sense subsurface temperature, salinity, chlorophyll fluorescence, and ocean currents
- Conduct monthly boat-based surveys
- Run ocean forecast models in real time including the Regional Ocean Modeling System (ROMS) and the Navy Coastal Ocean Model (NCOM)

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GULF OF MEXICO REGION

The Gulf of Mexico Region includes the coastal states from Florida to Texas. In 2009, two RCOOS implementation awards were provided to Texas A&M University totaling \$573,085. The 2009 Regional Association Planning Grant award to this region is \$399,998.

Project Title:

Maintenance and Enhancement of the GCOOS Data Portal: Building Toward a Regional Operations Center

Recipient/ Lead Principal Investigator:

Texas A&M University/ Dr. Ann Jochens (*ajochens@tamu.edu*)

Cost:

Funded: FY 2008 (Year 1) - \$350,000

FY 2009 (Year 2) - \$350,000

Proposed (subject to available funds): Year 3 - \$800,734

Performance:

The overarching goal of this project is to develop an integrated data framework for data streams, quality assurance procedures, and data delivery. This will be achieved through four objectives to: maintain and enhance the data portal beyond 2008; develop and refine a comprehensive data management system; build a pre-operational Regional Operations Center (ROC), and; develop educational resources for significant IOOS outreach efforts. This project builds upon current efforts to design and build a centralized data portal for the Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS-RA).

Schedule:

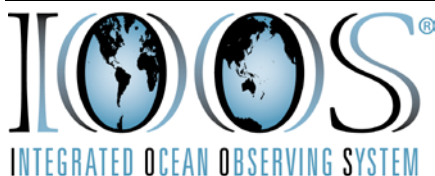
1. Year 1

- Roll out data portal for general use; begin collecting usage statistics
- Test and refine data portal: conduct internal and external reviews; establish web-based user feedback mechanism; evaluate user satisfaction results
- Assemble education and outreach web resources team and design web resources page
- Assemble kiosk exhibitory team

2. Year 2

- Maintain and enhance data portal as resources allow
- Add model output to data portal
- Add new data providers and new data types to data portal

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- Implement Open Geospatial Consortium Sensor Web Enablement suite of standards specifications for use by data providers
 - Develop educational lesson plans and resources
 - Plan, formalize, and implement Data Management Policy
 - Begin planning for pre-operational Regional Operations Center (ROC)
 - Install educational ocean observing kiosks at the Florida Aquarium and the Texas State Aquarium
3. Year 3 (subject to available funds)
- Maintain and enhance data portal as resources allow
 - Continue to add new data and model output to data portal
 - Update educational lesson plans and resources
 - Review and revise Data Management Policy
 - Plan pre-operational ROC elements
 - If funding allows, develop pre-operational ROC: develop metrics; design, construct, and test ROC; and develop transition plan from pre-operational to operational
 - Install educational ocean observing kiosks at the Dauphin Island Sea Lab's Estuarium (AL), the Aquarium of the Americas (LA), and the J.L. Scott Marine Education Center (MS).
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Project Title:

Standardization of Local Data Network Nodes in the Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS-RA)

Recipient/ Lead Principal Investigator:

Texas A&M University/ Dr. Ann Jochens (*ajochens@tamu.edu*)

Cost:

Funded: FY 2007 (Year 1) – \$297,868
FY 2008 (Year 2) – \$223,085
FY 2009 (Year 3) – \$223,085

Performance:

This project will standardize elements of the near real-time marine data delivery systems of ten major non-federal data providers of the Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS-RA). Uniform data delivery systems will be developed that maximize interoperability within the region, between regions, and with the federal backbone to facilitate production of operational data and model products in support of regional and national needs. The three specific objectives are to: 1) establish a single common vocabulary for variables served; 2) serve point and vector data via an Open Geospatial Consortium (OGC) compliant Sensor Web Enablement (SWE) framework, comprised of Sensor Observation Service and Observation and Measurement standards, and; 3) serve satellite data via an OGC Web Coverage Service (WCS) service interface.

Schedule:

1. Year 1
 - Establish a single common vocabulary for variables served by region
 - Node managers attend one regional DMAC planning and coordination meeting
 - Develop a common data model for and serve near real-time scalar data (e.g., temperature and salinity)
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- Satellite provider nodes select which satellite data to serve
 - Each node serving in-situ data starts participation in the IOOS Regional Observation Registry Program
2. Years 1-3
 - Implement vocabulary changes at each node
 - Each node participates in the IOOS Regional Observation Registry Program
 3. Year 2
 - Develop a common data model for and serve near real-time vector data (e.g., current speed and direction)
 - Select/develop method for and serve near real-time satellite data through WCS interface
 - Each node serving satellite data starts participation in the IOOS Regional Observation Registry Program, if the Registry has the capability to accept satellite data
 4. Year 3
 - Serve archived scalar and vector data via the SWE interface
 - Serve archived satellite data through WCS interface
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GREAT LAKES REGION

The Great Lakes Region includes the coastal zone within the states of New York, Pennsylvania, Ohio, Indiana, Illinois, Wisconsin, Minnesota, and Michigan, bordering on the Great Lakes and St. Lawrence River. The 2009 RCOOS award to this region is \$350,000. The 2009 Regional Association Planning Grant award to this region is \$400,000.

Project Title:

Implementation of the Great Lakes Observing System

Recipient/ Lead Principal Investigator:

Great Lakes Observing System, Jennifer Read (jenread@umich.edu)

Cost:

Funded: FY 2008 (Year 1) - \$350,000
FY 2009 (Year 2) - \$350,000
Proposed (subject to available funds): Year 3- \$1,381,500

Performance:

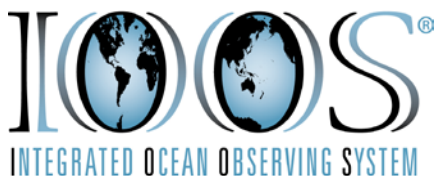
The Great Lakes Observing System (GLOS) focused in the first year on four tasks that support regional observation priorities: 1) implementation of prototype nearshore buoys on lakes Superior, Michigan, Erie and Ontario to collect meteorological, wave information, and vertical lake temperature observations; 2) development of public domain 3D hydrodynamic modeling for the lakes Huron-to-Erie Corridor (HEC), including Lake St. Clair; 3) expansion of the development, user assessments and market analysis of customized integrated harbor specific products (Great Lakes HarborView), and; 4) implementation of the Great Lakes Modeling and Assessment Center (GLMAC). Year two extends and enhances the four primary tasks begun in year one, with the anticipation that increased funding in year three would lead to more extensive observations, providing system-wide coverage, and related user-defined products.

Schedule:

1. Year 1

- Deploy five prototype buoys to record temperature, meteorology, currents, and water chemistry
- Develop Huron to Erie Corridor (HEC) hydrodynamic models, including validation, and online products (hourly forecasts of levels, flows and currents) to support drinking water utilities, beach managers, recreational boaters, commercial navigation interests, oil/toxic spill responders and search/rescue operations

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- Conduct detailed assessment of the acceptability of the HarborView pilot products by commercial and recreational boating communities
2. Year 2
 - Host workshop of GLOS PIs and resource managers in year 2 to discuss placement of observing platforms, and identification of observational parameters and models/tools to support decision-making
 - Implement changes to HarborView that will meet needs identified for the Upper St. Lawrence River and the St. Marys River.
 3. Years 1-2 (Activities deferred due to reduced funding support)
 - Develop customized HarborView products: web-based nearshore currents, winds, waves, and prevailing weather for all harbors on each of the five Great Lakes
 - Stand up the Great Lakes Modeling and Assessment Center as a clearinghouse for modeling tools and as a virtual center for running pre-operational models
 - Outreach, membership recruitment, curriculum development, Data Management and Communications, systems management workshops, and coordination efforts
 - Deploy a standardized set of 14 buoys to collect physical and chemical observations in close proximity to major municipal water intakes and public bathing beaches
 - Produce new products derived from airborne and satellite observations
 - Implement pre-operational assessments for the integrated HEC Waterways Forecasting System
 - Develop high resolution grids for nearshore areas adjacent to major metropolitan water intakes as part of the Great Lakes Coastal Forecasting System
 4. Year 3
 - Expand model development to other waterways, including St. Marys and St. Lawrence rivers

NOAA IOOS Program Office Contacts:

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Regina Evans (Regina.Evans@noaa.gov), Grants Administrator



FY2009: Regional Integrated Ocean Observing System Development

NOAA continued a merit-based funding process in 2009 to enhance regional coastal ocean observing systems (RCOOSs) and achieve three long-term outcomes: establishing coordinated regional observing and data management infrastructures, developing applications and products for regional stakeholders, and crafting regional and national data management and communications protocols. In addition, regional associations received planning grant awards designed to assist them in stakeholder engagement, education and outreach, and long-range planning activities.

MID-ATLANTIC REGION

The Mid-Atlantic Region includes the coastal states from Cape Cod to Cape Hatteras. In 2009, implementation funds were provided to two recipients totaling \$2,072,200. The 2009 Regional Association Planning Grant award to this region is \$400,000.

Project Title:

Phased Deployment and Operations of the Mid-Atlantic Regional Coastal Ocean Observing System (MARCOOS)

Recipient/ Lead Principal Investigator:

Rutgers, the State University of New Jersey/ Dr. Scott Glen (glenn@marine.rutgers.edu)

Cost:

Funded: FY 2007 (Year 1) - \$1,700,000
FY 2008 (Year 2) - \$1,700,000
FY 2009 (Year 3) - \$1,700,000

Performance:

This project will leverage existing regional observation assets to achieve three primary objectives: observations, modeling, and data management. Investigators will coordinate, sustain, and expand on-going ocean observing and forecasting activities to generate regional-scale data and other products in real-time across the full Mid-Atlantic region and extending in the Bays and Sounds.

The focus in Year 1 was on observation and forecasting of two-dimensional surface currents to support maritime safety. The work in Years 2 and 3 will continue the progress made in Year 1, furthering observation activities such as current mapping, glider observations, and satellite data forecasts. In addition, the region will focus on statistical and dynamical ocean modeling, and will increase data management and communications (DMAC) and education and outreach efforts.

In its first two years, MARCOOS accomplished its goal of addressing two primary regional themes: 1) making regional 2-D surface current maps from CODAR and the Short Term Prediction System statistical forecast model operational with the Coast Guard's Search and Rescue Operations; and 2) making 3-D temperature fields available to managers of recreational and commercial fisheries to support ecosystem based management.

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Schedule:

1. Years 1-2
 - Inventory 26 High Frequency (HF) Radar Sites in online database
 - Standardize hardware and software setting throughout HF Radar network
 - Standardize Quality Assurance/Quality Control (QA/QC) radial data settings throughout HF Radar network
 - Implement Short Term Prediction System (STPS) throughout MARCOOS domain
 - Define data streams for assimilation, quality control, error estimate, and DMAC
 - Develop real-time data streams for assimilation
 - Format WeatherFlow data in Network Common Data (NetCDF) format
 - Develop the Optimal Interpolation (OI) combiner
 - Share HF Radar and STPS data via OPeNDAP
 - Demonstrate MARCOOS-wide glider capability
 - Engage New Jersey coastal community on near-shore currents and waves
 - Leverage MACOORA grant to assess 3-D visualization techniques for fisheries
 - Conduct background assessment of economic impact of fisheries
2. Years 1-3
 - Operate and update HF Radar system consistent with existing best practices
 - Evaluate other vector algorithms with West Coast sites for HF QA/QC
 - Operate and maintain STPS
 - Support MACOORA DMAC needs, coordinate with national DMAC efforts
 - Operate and maintain local L-Band and X-Band satellite systems
 - Evaluate Drifter assimilation
 - Formulate quantitative skill metrics for dynamical modeling
 - Develop assimilation methodology for real-time ready models
3. Year 2
 - Build network-wide HF Radar diagnostic monitoring
 - Install redundant/high speed communications for HF Radar where possible
 - Perform HF Radar site relocations as identified in the first 6 months
 - Test and evaluate new merging algorithm and vector metrics (HF Radar QA/QC)
 - Implement DIF-recommended data sharing protocols, making the declouded SST imagery available in netCDF format via OPeNDAP for modelers and other advanced users, and making images of the data available on the Rutgers website for the general public.
 - Develop concept of operations, recovery resource list, decision tree for underwater glider operations
 - Implement CTD (a measurement of temperature and depth) database through OPeNDAP
4. Years 2-3
 - Analyze and re-measure antenna patterns for best HF Radar performance
 - Draft best practices document consistent with national HF Radar network
 - Test and evaluate HF Radar antenna pattern sensitivity, revisit settings with hardware group based on tests
 - Develop web-portal for requests to the combiner
 - Share dynamical forecasts via OPeNDAP

- Incorporate levered products from other satellite sources in MARCOOS
 - Participate in fisheries summit
 - Conduct underwater glider demonstration project
 - Expand education through region with Sea Grant partnerships
 - Leverage NSF grant to build web-based fisheries learning community
 - Conduct initial assessment of economic benefits demonstration impacts
-

Project Title:

Chesapeake Inundation Prediction System (CIPS): Flood Forecast Prototype for Coastal-Bay-Estuary Resiliency to Storm Surge

Recipients/ Lead Principal Investigators:

Chesapeake Bay Research Consortium/ Kevin Sellner (*sellnerk@si.edu*) and Chesapeake Bay Observing System (CBOS)/ Elizabeth Smith (*exsmith@odu.edu*)

Cost:

Funded: FY 2007 (Year 1) - \$500,000
 FY 2008 (Year 2) - \$372,200
 FY 2009 (Year 3) - \$372,200

Performance:

The Chesapeake Inundation Prediction System (CIPS) is being developed to improve the accuracy, reliability, and capability of flood forecasts for tropical cyclones and non-tropical wind systems such as nor'easters. Investigators from government, industry and academia will construct, evaluate, and deliver a prototype inundation forecasting system to facilitate emergency management and decision-making in the challenging case of intricate coastlines-semi-enclosed coastal bays and estuaries. The overarching goal of the CIPS project, modified as a result of funding reductions, is to deliver a demonstration forecasting and visualization capability at very high resolution for selected locations within the following Chesapeake Bay areas: Hampton Roads in Virginia, Talbot/Dorchester Counties in MD, and the Upper Potomac River/Alexandria, Virginia.

The first major task will expand the technique of ensemble forecasting in the atmospheric domain and translate it to the hydrodynamic and hydrologic domains. To accomplish this, parallel, high-resolution atmospheric forecasts for the region will be produced on an operational schedule. The ensemble will then include hydrodynamics, combining models with the stochastic hydrologic flow to produce high-resolution, operational forecasting in the region. The primary benefits are improved accuracies and quantitative estimates of forecast uncertainties. For the second major task, investigators will exploit a successful prototype visualization, validation, and information-delivery system for emergency managers. Part of this system is a new, rapid system to deploy inundation sensors immediately before storms to obtain direct measurements of water levels. A dynamic outreach program with Emergency Managers (EMs) will integrate and assess the value of this system, not only for the immediate storm response by EMs, but also for their advance planning and decision-making during recovery. The project team will work to address their requirements and deliver the visual inundation information at city-block resolution at a variety of sites for the purposes of immediate storm response and advance planning and decision-making during recovery. CIPS ultimately will provide an end-to-end system that: defines users' needs; integrates the subsystems for observation, forecasting, visualization, validation, data and product development, and; communicates high-resolution products to EMs, and then to a broad spectrum of users, including the general public.

Schedule:

1. Year 1

- Assemble data sets for two representative storms and run initial forecasts and inundation visualizations for three areas in the Chesapeake Bay: Washington, DC-Alexandria, VA; Norfolk-Virginia Beach, VA; and Dorchester-Talbot Counties, MD
- Form emergency manager (EM) user teams in each area to develop and review CIPS products, information delivery techniques, and accompanying economic impact evaluation
- Develop a rapid deployment overland sensor network design for one of the two selected overland areas
- Develop an initial automated visualization processing capability to ingest and display hydrodynamic modeling results

2. Year 2

- Evaluate and refine prototype forecast products and configure models for operational use.
- Develop and refine visualization and information products
- Improve methods for tracing how inundation information is used and what benefits it generates
- Continue to interview EMs for economic impact evaluation

3. Year 3

- Evaluate the ensemble forecasts. Use any new significant (i.e., tropical or extratropical) events that result in major flooding to aid in this refinement
- Expand the applications of the 12-hour ensemble hydrodynamic forecast technique (to areas such as Annapolis and Baltimore)
- Develop visualization tools for most efficient use by forecasters
- Convey products to emergency managers and other end-users
- Finalize operational prototype inundation forecast-delivery system and deliver to Weather Forecast Offices (WFOs)
- Transfer prototype capability and documentation of end-to-end process to MACOORA and work with other regions to transfer the CIPS capability
- Complete performance evaluation and economic impact assessment
- If current forecast capability indicates, obtain all relevant observational data and information needed to model one (tropical or extra-tropical) overland flooding event in each of two overland areas with CIPS and validate the model output. The targeted storm period is March 1, 2010 through November, 2010

NOAA IOOS Program Office Contacts:

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FY2009: Regional Integrated Ocean Observing System Development

NOAA continued a merit-based funding process in 2009 to enhance regional coastal ocean observing systems (RCOOS) and achieve three long-term outcomes: establishing coordinated regional observing and data management infrastructures, developing applications and products for regional stakeholders, and crafting regional and national data management and communications protocols. In addition, regional associations received planning grant awards designed to assist them in stakeholder engagement, education and outreach, and long-range planning activities.

PACIFIC NORTHWEST REGION

The Pacific Northwest Region includes the coastal states of Washington, Oregon, and northern California. The 2009 RCOOS award to this region is \$1,500,000. The 2009 Regional Association Planning Grant award to this region is \$400,000.

Project Title:

Enhancing the Pacific Northwest Regional Coastal Ocean Observing System (RCOOS) of the Northwest Association of Networked Ocean Observing Systems (NANOOS)

Recipient/ Lead Principal Investigator:

University of Washington/ Dr. David Martin (dmartin@apl.washington.edu)

Cost:

Funded: FY 2007 (Year 1) - \$1,500,000
FY 2008 (Year 2) - \$1,500,000
FY 2009 (Year 3) - \$1,500,000

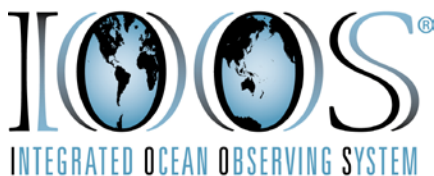
Performance:

To progress on the NANOOS regional priorities of maritime operations, fisheries, ecosystem impacts, and coastal hazards, this project will develop the essential subcomponents of the Pacific Northwest RCOOS: observing systems, modeling and products, data management and communications (DMAC), and education and outreach. The work will be applied in four observational domains: coastal ocean shelf, coastal ocean surface currents, estuaries, and shorelines. The primary goals of the project are to: 1) maintain existing surface current mapping capabilities and expand to include short-term forecasting at a priority port location; 2) expand coverage and range of observations on the coastal ocean shelf in coordination with emerging national programs with fixed buoys and gliders that will provide information on hypoxia/anoxia and harmful algal blooms (HABs); 3) maintain and expand observations in estuaries through improved maintenance and staff support, including partnerships at local, state, and federal levels, and; 4) maintain and expand core elements of existing beach and shoreline observing programs in Oregon and Washington.

Schedule:

1. Years 1 - 3
 - Maintain Oregon High Frequency (HF) Radar sites
 - Maintain coastal buoy in Newport, Oregon, line for hypoxia/anoxia alerts

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- Maintain some moorings in Puget Sound, Columbia River, Willapa Bay, Gray's Harbor, and South Slough
 - Maintain quarterly topographic profiles and 3-D topographic beach surface mapping
2. Year 1
- Develop conceptual systems architecture design in compliance with IOOS standards and protocols, network engineering design, and Web interface specifications
 - Hire a full-time NANOOS Education and Outreach Specialist; develop education materials for NANOOS focus areas
 - Purchase equipment for coastal buoy at Juan de Fuca eddy for HAB warning focus
3. Year 2
- Purchase and install one X-Band port radar system at high priority port
 - Purchase equipment to refurbish Oregon buoy
 - Continue to refine and implement NANOOS DMAC systems architecture across NANOOS domain with initial nodes at UW, Boeing, OHSU, and OSU
 - Continue NANOOS Education and Outreach Specialist work with NANOOS administration, E&O Standing Committee, User Products Standing Committee, and other stakeholders to derive high-priority, user-driven products
 - Initiate delivery of marine education material via web (Ed-Web); specifically focus on enhancing ongoing Pacific Northwest marine education efforts
 - Continue development of materials for NANOOS focus areas according to stakeholder prioritization between fisheries, maritime operations, coastal hazards, and ecosystem impacts; implement training of prioritized target groups throughout the region
4. Year 3
- Support glider operations off Newport, Oregon, line for hypoxia/anoxia alerts
 - Stabilize fully mature NANOOS DMAC systems architecture across NANOOS domain; ensure exportability to other regional association efforts and national enterprise
 - Continue work by NANOOS Education and Outreach specialist; liaise with stakeholders to assess efficacy of education and outreach efforts, continue outreach of materials in four NANOOS focus areas
 - Focus on development with state agencies and others for coastal hazards
 - Expand development of products based on user input
 - Continue training of prioritized target groups throughout the region
-

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FY2009: Regional Integrated Ocean Observing System Development

NOAA continued a merit-based funding process in 2009 to enhance regional coastal ocean observing systems (RCOOS) and achieve three long-term outcomes: establishing coordinated regional observing and data management infrastructures, developing applications and products for regional stakeholders, and crafting regional and national data management and communications protocols. In addition, regional associations received planning grant awards designed to assist them in stakeholder engagement, education and outreach, and long-range planning activities.

NORTHEAST ATLANTIC REGION

The Northeast Atlantic Region includes the coastal states from Maine to Connecticut. In 2009, implementation funds were provided to three recipients totaling \$1,855,772. The 2009 Regional Association Planning Grant award to this region is \$400,000.

Project Title:

Development of the Northeast Regional Coastal Ocean Observing System

Recipient/ Lead Principal Investigator:

Woods Hole Oceanographic Institution/ Dr. John Trowbridge (jtrowbridge@whoi.edu)

Cost:

Funded: FY 2007 (Year 1) - \$1,200,000
FY 2008 (Year 2) - \$1,200,000
FY 2009 (Year 3) - \$1,324,787

Performance:

This project develops the Northeastern Regional Coastal Ocean Observing System. Regional user requirements identified inundation, harmful algal blooms, water quality, and living marine resources as specific concerns in the Northeastern Region. The project, as originally proposed in April 2007, had three goals: (1) operate a core of observing elements; (2) establish new observing capabilities for inundation, water quality, and harmful algal bloom, and (3) develop the design for the user-driven core observing system. In response to the reduced budget relative to the original funding request, the focus has been on continued operation of selected elements of the existing regional observing system, with a modest commitment to enhancement of observing capabilities.

Schedule:

1. Year 1
 - Complete development of the Northeast Coastal Ocean Forecast (NECOFS) model that features three core model components (mesoscale weather, waves, and coastal ocean) to provide forecast capacity for marine surface weather, ocean environment, and inundation.
 - Establish a steering team of educators and scientists to share ideas on education and outreach products
2. Years 1-3
 - Develop data management and communication systems

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- In the Gulf of Maine, maintain five of 11 existing buoys, the University of New Hampshire's Coastal Ocean Observing Center (COOA) buoy in Great Bay; and one buoy in the Long Island Sound Coastal Ocean Observing System
 - Maintain HF radar, operational circulation model, surface wave model, and satellite data analysis and dissemination for the Gulf of Maine
 - Extend shipboard surveys associated with the Atlantic Zone Monitoring Program emphasizing nutrient measurements to five new stations
3. Year 2
- Enhance HAB monitoring in the Bay of Fundy with the addition of extra stations and facilitation of sample analysis and compilation
 - Improve the NECOFS by adding the surface wave forecast and validating the accuracy of forecasts with direct comparison through field data
4. Years 2-3
- Support existing moorings and buoys in Long Island Sound and Block Island Sound
 - Deploy nutrient sensors on existing buoys and moorings in the Gulf of Maine, Great Bay, Long Island Sound, and Block Island Sound; deploy an in-situ sensor for detecting the presence of harmful algal blooms on an existing platform; deliver products for inundation
5. Year 3
- Implement data management and communication systems
 - Integrate Northeast Fisheries Science Center (NEFSC) data streams into the NERACOOS system
 - Develop education products based on real-time and historical data for water quality, harmful algal blooms, living marine resources, and coastal inundation
-

Project Title:

Maximizing the Economic Return from Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS): Prioritized End User Needs and Tools for Tracking Use and Value of Observing System Information

Recipient/ Lead Principal Investigator:

Woods Hole Oceanographic Institution/ Dr. Hauke L. Kite-Powell (*hauke@whoi.edu*)

Cost:

Funded: FY 2007 (Year 1) - \$156,181
FY 2008 (Year 2) - \$110,150
FY 2009 (Year 3) - \$158,785

Performance:

The purpose of this project is to: 1) work with prospective end-users of ocean observing system products in the Gulf of Maine/New England area to ensure that information generated by Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS) effectively addresses end-user needs; and (2) develop and implement a system to track the use of regional observing system information by end-users and document the economic value generated by this information. This will involve three main activities: 1) identify user priorities and information products to address inundation, harmful algal blooms, water quality, and living marine

resources management, 2) develop usage tracking and economic assessment tools, and 3) adapt the tools to be used by other regional ocean observing systems.

Schedule:

1. Year 1
 - Develop economic valuation models to estimate the value generated by NERACOOS information; design model and establish data requirements
 - Develop tools to track use of NERACOOS information by end users
 2. Years 1-2
 - Conduct meetings for stakeholder user group assessment and feedback
 - Based on user needs, characterize products and coordinate with NERACOOS
 - Develop economic valuation model and baseline scenarios
 3. Years 2-3
 - Develop training materials and provide training on tracking tools
 - Estimate the economic value generated by the use of NERACOOS information; conduct assessment of usage data and benefit
 - Collect and analyze data on the use of NERACOOS products
 - Provide final report and tools with documentation
-

Project Title:

A Northeast Benthic Observatory (NEBO) to Support Multi-Species Fisheries and Ecosystem Management

Recipient/ Lead Principal Investigator:

Woods Hole Oceanographic Institution/ Dr. Scott Gallagher (*sgallager@whoi.edu*)

Cost:

Funded: FY 2007 (Year 1) - \$569,506
FY 2008 (Year 2) - \$372,200
FY 2009 (Year 3) - \$372,200

Performance:

This project will collect and analyze spatially comprehensive high resolution seafloor imagery to quantify key taxa, benthic community structure, species diversity, seafloor habitat characteristics, and coincident water column properties with repeated measurements on time scales of weeks to years. Data collection will be at locations with high fisheries and conservation value, such as the western Gulf of Maine. Project objectives are to: 1) establish four locations to collect imagery where benthic community structure, the coupling between the water column and benthic community, and system change over time scales of days to years will be quantified; 2) develop tools for integration of fisheries relevant data to segment and classify epi-benthic targets and substrate, and to visualize the results in near real-time; and 3) establish metrics for quantifying change in benthic community structure, organism abundance and size distribution of a variety of taxa relative to substrate composition in relation to water column processes.

Schedule:

1. Year 1
 - Conduct sampling in four sentinel sites
 - Develop tools for automated image processing and classification
-

- Build statistical metrics for describing ecosystem change
 - Co-register optical and acoustic data.
 - Serve raw image data over web
 - Integrate data on water column and benthic processes
 - Define data products relevant to end users
 - Begin extracting image information for development of data products
2. Years 2 - 3
- Produce data products in near real-time during each survey and serve over web
 - Continue to collect field data at the four sentinel sites
3. Year 3
- Compile and statistically analyze time series data products
 - Finalize data extraction protocols and process archived data
 - Develop automated segmentation code
 - Conduct societal impact modeling
 - Conduct automated image processing
 - Provide temporal/spatial context for events during study (e.g., storms, climate change)
 - Establish performance metrics and develop a cost-benefit model for the impact of NEBO on commercial fisheries
-

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FY2009: Regional Integrated Ocean Observing System Development

NOAA continued a merit-based funding process in 2009 to enhance regional coastal ocean observing systems (RCOOS) and achieve three long-term outcomes: establishing coordinated regional observing and data management infrastructures, developing applications and products for regional stakeholders, and crafting regional and national data management and communications protocols. In addition, regional associations received planning grant awards designed to assist them in stakeholder engagement, education and outreach, and long-range planning activities.

PACIFIC ISLANDS REGION

The Pacific Islands Region is defined as the State of Hawaii, Commonwealth and Territories of the United States in the Pacific, and the Freely Associated States in the Pacific. The 2009 RCOOS award to this region is \$1,869,134 for a demonstration project focused on the south shore of Oahu, Hawaii. The 2009 Regional Association Planning Grant award to this region is \$398,802.

Project Title:

Developing the Hawaii-Pacific Ocean Observing and Information System

Recipient/ Lead Principal Investigator:

University of Hawaii/ Dr. Brian Taylor (taylorb@hawaii.edu)

Cost:

Funded: FY 2007 (Year 1) - \$1,700,000
FY 2008 (Year 2) - \$1,700,000
FY 2009 (Year 3) - \$1,869,134

Performance:

The objective of this project is to integrate and expand ocean observing and forecasting first in the Hawaiian Islands, and later among the Pacific Islands as part of a larger Pacific Islands Ocean Observing System (PacIOOS). Investigators will begin with four integrated “catalyst” projects focused initially on waters along the southern shore of Oahu, Hawaii’s most populous island. These catalyst projects support one another to enhance community capabilities and respond to the needs of a diverse constituency of stakeholders are: (1) coastal ocean-state and forecast; (2) coastal resiliency; (3) automated water quality sensing, and; (4) marine ecosystem stewardship. Resultant products will contribute to near-shore and offshore safety, shipping and marine commerce, water quality assessments, marine ecosystem indicators, and marine inundation forecasts.

For the coastal ocean-state and forecast project, investigators will utilize an array of high frequency Doppler radios, along with gliders, wave buoys, coastal cameras, and numerical models. This project will monitor, model, and predict channel and near-shore circulation, waves, coastal run-up, and water levels. Observations and model output will feed into a dynamic, web-based coastal ocean atlas providing interpretive products such as most efficient inter-island shipping lanes, hazardous conditions at beaches and in harbors, pollutant dispersion, and high water levels in vulnerable communities. The coastal resiliency project products will include: frequently updated maps of specific beach safety conditions; coastal inundation and erosion alerts, and; vulnerability projections related to sea-level rise, chronic erosion, and high wave and water level events. The automated water quality sensing project efforts will expand and implement modifications of existing coastal water quality monitoring. The proposed system, when combined with circulation models, will provide early

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warning of impending water quality problems, improve prediction of affected areas, and decrease response time for mitigation efforts. The marine ecosystem stewardship project team will focus on expanding existing cetacean monitoring arrays. Stewardship products will include fishing and marine mammal forecasts to help interpret impacts of long-term climate change on living marine resources.

Schedule:

1. Year 1

- Deploy one glider.
- Bring key data and products on-line (glider subsurface temp/salinity, sea level heights/trends, wave state, NLOM/NCOM ocean state products, autonomous underwater vehicle (AUV) survey products, surface winds)
- Deploy observation equipment (Koko Head and Barbers Point Coastal Radars, nearshore water quality stations, directional wave buoys, Ecological Acoustic Recorders (EAR) at Kilo Nau, yellow fin tuna transmitters)
- Deploy AUV surveys and event surveys
- Conduct topographic LIDAR surveys
- Operate circulation models (RSM/MSM atmospheric model, Regional Ocean Modeling System (ROMS) model, regional wave model)
- Develop software for real time detection of cetacean sounds
- Develop database and web system
- Deploy beach cameras and near-shore sensor packages

2. Year 2

- Deploy 1-2 gliders continuously
- Deploy additional observation equipment (Barbers Point water level/seiche stations, deep EAR sensor, Waikiki beach cameras)
- Operate priority models (weather research and forecast (WRF), atmospheric model, Hybrid Coordinate Ocean Model/Pacific Ocean Model (HYCOM/POM), Oahu south shore model, ecosystem model)
- Continue development of database and web system
- Bring additional key products on-line (radar surface current maps, water quality products, inundation products, HYCOM/POM products)

3. Year 3

- Bring additional products/data on-line (marine mammal occurrence, biological activity, vessel traffic, inundation products, run-up products)
- Continue development of database and web system
- Assimilate data into WRF and ROMS models

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FY2009: Regional Integrated Ocean Observing System Development

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SOUTHERN CALIFORNIA REGION

The Southern California Region runs south from Point Conception to the Mexico border. In 2009, three implementation awards were provided to recipients at the University of California at San Diego, Scripps Institution of Oceanography totaling \$1,341,466. The 2009 Regional Association Planning Grant award to this region is \$393,093.

Project Title:

Implementation of Regional Integrated Ocean Observing System: Southern California Regional Coastal Ocean Observing System (SCCOOS)

Recipient/ Lead Principal Investigator:

University of California at San Diego, Scripps Institution of Oceanography/
Dr. Eric Terrill (eterrill@ucsd.edu)

Cost:

Funded: FY 2008 (Year 1) - \$500,000
FY 2009 (Year 2) - \$781,529

Performance:

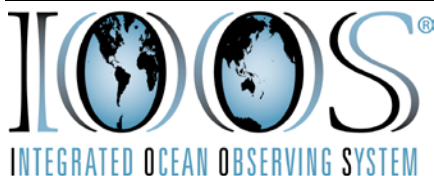
This project expands activities identified as priorities by the SCCOOS stakeholder community. These include supporting the southern California beach water quality management community with issues related to Harmful Algal Blooms (HABs), maintaining area-wide ocean assessment to identify secular trends in the environment and their relationship to ecosystem variability; supporting operational users, such as search and rescue, oil spill response, and marine safety, as well as managing and distributing ocean information of public interest. This project focuses on a HAB surveillance program, long-line glider tracks at northern and southern SCCOOS boundaries, forecasts and nowcasts of ocean and atmospheric conditions, acquisition of nearshore larval and fish counts to complement the California Department of Fish and Game management of fisheries, and High Frequency (HF) radar operations.

Schedule:

Year 2

- Conduct nearshore egg and larval surveys for in-shore California Cooperative Oceanic Fisheries Investigations (CALCOFI) stations
- Conduct HAB surveillance program and website
- Operate a real-time operational atmospheric model at 1-km

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- Maintain and operate Regional Ocean Modeling System (ROMS) at 1-km over southern California Bight
 - Maintain existing lines of long-line glider tracks at northern and southern SCCOOS boundaries
 - Maintain and operate HF Radar
 - Maintain SCCOOS data feeds, data delivery, IOOS DMAC, and the SCCOOS website
 - Develop and run training workshops
-

Project Title:

Using Ocean Data Assimilation to Incorporate Environmental Variability into Sardine and Squid Assessments

Recipient/ Lead Principal Investigator:

University of California at San Diego, Scripps Institute of Oceanography/
Dr. Arthur J. Miller (*ajmiller@ucsd.edu*)

Cost:

Funded: FY 2007 (Year 1) - \$474,559
FY 2008 (Year 2) - \$353,785
FY 2009 (Year 3) - \$353,785

Performance:

This project will study the influence of physical oceanography on the populations of sardine and squid by selecting key El Niño and La Niña time periods (which represent environmental extremes) for intensive analysis, comparison, and contrast to typical conditions. The project will include extensive analysis of the various IOOS data using sophisticated ocean data assimilation tools. The overall goals are to develop a coupled ecological and hydrologic model for assessing and predicting the physical oceanographic influences on sardine and squid stocks using both IOOS and federal and state fisheries data.

The primary steps in accomplishing this project are: 1) study the physical oceanographic state during the key years using sophisticated ocean data assimilation tools of the Regional Ocean Modeling System (ROMS); 2) relate the biological observations to the time-evolving physical state using statistical models; and 3) evaluate the predictive capability of the physical-biological system using independent years of data. The end goal is to deliver the system to stock assessment managers through the Southwest Fisheries Science Center. The resulting forecast will be presented to the sardine and squid stock managers and scientists for consideration in the catch quotas for these species.

Schedule:

1. Year 1
 - Assemble physical oceanographic datasets for assimilation during key years
 - Test forward run in ocean model domain for first key time period
 - Begin inverse method data assimilation for first key time period
 2. Years 1-2
 - Assemble biological datasets
 3. Years 1-3
 - Present initial results at scientific meetings and workshops, discuss results with the Pacific Marine Fisheries Management Council and the Coastal Pelagic Species Management Team
 - Analyze zooplankton samples
-

- Analyze squid egg bed habitats
 - Conduct diet and plankton investigation in the laboratory and at sea
 - Examine sardine feeding morphology and diet
 - Investigate physical factors that influence abundance/distribution of suitable planktonic prey
4. Year 2
 - Complete inverse method data assimilation for first key time period
 - Test forward run in ocean model domain for second key time period
 5. Years 2-3
 - Use diagnostic tools to analyze ocean model fits for some physical processes affecting biology
 6. Year 3
 - Begin and complete inverse method data assimilation for second key time period
 - Integrate sardine prey production with physical ocean model fits
 - Examine model ability to accurately predict temporal and spatial variation in sardine recruitment
 - Present and publish results
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Project Title:

Long Beach/Los Angeles Harbor IOOS Demonstration Project

<http://www.sccoos.org/data/harbors/lalb/fullscreen.php>

Recipient/ Lead Principal Investigator:

University of California at San Diego, Scripps Institution of Oceanography/

Dr. Eric Terrill (*eterrill@ucsd.edu*)

Cost:

Funded: This project was selected in FY07 and all three project years (FY07-FY09) were fully funded with FY07 dollars at a total project cost of \$99,999.

Performance:

This project will integrate regional assets by leveraging existing observations, models, and data management to develop products that contribute to the safety and efficiency of maritime transportation. The proposed customized website for Long Beach/Los Angeles Harbor entrance is designed to provide critical marine conditions necessary for the safe passage inbound and outbound from Long Beach/Los Angeles Harbor.

Present infrastructure and methodology is used to collect, analyze, and disseminate wave and surface currents data in near real-time. The following parameters will be integrated in the web display: wave measurements, model wave nowcasts and forecasts, sea surface temperature (in-situ and remote), HF radar-derived surface currents, tides, and modeled winds. The final website design will include information windows activated on the display map for areas of interest as selected by the stakeholders. The intent is that maritime traffic users will access near real-time data for immediate transit decisions or forecast information for planning purposes.

Schedule:

1. Year 1
 - Aggregate existing relevant assets for website products
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- Develop Federal Geographic Data Committee (FGDC) compliant XML metadata and use a common data model
 - 2. Years 1-3
 - Meet with Los Angeles/Long Beach (LA/LB) Harbor stakeholders at project start, mid-point, and end of year to obtain input and feedback
 - Refine website development
 - Transmit data to NOAA National Data Buoy Center
 - 3. Year 2
 - Hold tutorial in Long Beach/Los Angeles area to train stakeholders in the most efficient and productive use of the website, and assure the optimum use of site as a decision-support tool
 - Meet with the San Diego maritime community concerning the implementation of a LA/LB type integrated/customized website for San Diego. Implement this San Diego site, including site specific stakeholder requests.
 - 4. Year 3
 - Meet with LA/LB and San Diego stakeholders to evaluate the applicability and usefulness of the product
-

Project Title:

High Frequency Radar National Network Data Management Development

Recipient/ Lead Principal Investigator:

University of California at San Diego, Scripps Institution of Oceanography/
Dr. Eric Terrill (eterrill@ucsd.edu)

Cost:

Funded: FY 2009 - \$280,000

Performance:

This project continues efforts to research, develop, and maintain the data management system for ocean current information derived from high-frequency (HF) radar.

Project Tasks:

1. Formally support and integrate Wellen Radar (WERA) data output within the national network
 2. Improve radial database query and access capabilities
 3. Automate database volume creation
 4. Prototype near real-time implementation of metrics provided by Codar Ocean Sensors
 5. Continue development and system management activities associated with implementation and operation of near real-time data system
-

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Regina Evans (Regina.Evans@noaa.gov), Grants Administrator



FY2009: Regional Integrated Ocean Observing System Development

NOAA continued a merit-based funding process in 2009 to enhance regional coastal ocean observing systems (RCOOS) and achieve three long-term outcomes: establishing coordinated regional observing and data management infrastructures, developing applications and products for regional stakeholders, and crafting regional and national data management and communications protocols. In addition, regional associations received planning grant awards designed to assist them in stakeholder engagement, education and outreach, and long-range planning activities.

SOUTHEAST ATLANTIC REGION

The Southeast Atlantic Region includes the coastal states from North Carolina to Florida. In 2009, RCOOS implementation funds were provided to four recipients totaling \$2,444,150. The 2008 Regional Association Planning Grant award to this region is \$391,991.

Project Title:

Implementation of Regional Integrated Ocean Observing Systems: Support of RCOOS Development in SECOORA

Recipient/ Lead Principal Investigator:

Southeast Coastal Ocean Observing Regional Association, Debra Hernandez (debra@secoora.org)

Co-Principal Investigator:

University of North Carolina at Chapel Hill, Dr. Harvey E. Seim (hseim@email.unc.edu)

Cost:

Funded: FY 2008 (Year 1) - \$400,000
FY 2009 (Year 2) - \$500,000
Proposed (subject to available funds): Year 3 - \$3,476,595

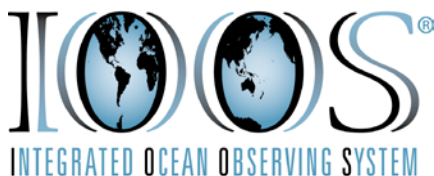
Performance:

This project originally proposed to consolidate Coastal Ocean Observing System (COOS) assets and products in the Carolinas with those in Georgia and Florida to establish a user-driven observing system that spans the entire SECOORA footprint. The foundation of the SECOORA RCOOS will build initially upon six primary elements included in this proposal: 1) maintenance and development of existing observing assets and consolidation of existing sub-regional observing systems; 2) construction of an integrated and embedded modeling system; 3) development of ecosystem models targeted at predicting the characteristics of regionally important fish stocks; 4) establishment of a data management system designed to disseminate rapid, high quality products; 5) establishment of a systems engineering based structure to the observing system architecture that enables the seamless interoperability, and; 6) integration of an end-user community into the fabric of SECOORA to ensure responsiveness to regional needs. Due to funding limitations for Years 1 and 2, and likely for Year 3, elements 1, 4 and 6 have been the only ones implemented to date.

Schedule:

1. Year 1

(over)



- Improve guidance and processes for data providers
 - Complete the redesign of the SECOORA website that will allow for the incorporation of existing data streams and format them as prescribed by target user groups, and complete the development of basic tailored interfaces that support specific communities of interest
2. Years 1-3
- Maintain operations and data flow from four HF Radar sites
 - Work with membership of SECOORA and its Stakeholders Advisory Council to prioritize elements of RCOOS growth
3. Year 2
- Establish accuracies of observed and simulated data (skill assessment) for all available physical components through appropriate comparisons and intercomparisons
4. Years 2-3
- To the extent feasible with the limited funding, sustain and enhance observing assets in the SECOORA domain, including buoys, offshore towers and coastal stations
 - Maintain High Frequency (HF) Radar measurement systems and provide data in near-real time
 - Coordinate with the U.S. Coast Guard (USCG) and MACOORA to enable surface current field input to the USCG Search and Rescue Operations application
 - Enhance and refine tailored interfaces to include aggregated near-real-time delayed mode, and model output data that supports the thematic priorities of waves, and search and rescue
 - Develop, test, and deploy a range of applications
 - Integrate national DMAC advances with SECOORA data management activities and ensure interoperability with other COOS efforts throughout the southeast region
5. Year 3
- Enable access to archival information
 - Coordinate with ecosystem and fisheries stakeholder groups to inform any modeling efforts
 - Regularly meet with other Regional Associations to share lessons learned and outreach initiatives
 - Work with COSEE-SE and COSEE GoM to develop standards-based curriculum based on fisheries/ecosystem management, waves, coastal hazards, and search and rescue activities
 - Sustain observing assets, to the maximum extent possible with funding provided, in the SECOORA domain, including buoys, offshore towers and coastal stations established through prior sub-regional and regional efforts
 - Estimate the accuracy of HF radar surface current estimates by establishing reliable error bars for stakeholder specific applications, and provide the data in near-real time to identified user groups such as USCG, local fisherman, modelers, and emergency planners
 - Establish accuracies of observed and simulated data (skill assessment) for all available physical components through appropriate comparisons and inter-comparisons
 - Sustain and enhance Nowcast/Forecast modeling systems currently used in the region
 - Implement locally-relevant ecosystem models to quantify the role of abiotic and biotic effects on the growth, survival and recruitment of target species in the SECOORA region
 - Develop nowcasting capabilities of oceanographic and ecosystem properties to provide relevant information for use in the South-East Data, Assessment, and Review (SEDAR) recruitment forecast process
 - Assess current operational processes
 - Define desired future state of the RCOOS, identify gaps and cost/schedule drivers

- Develop methodologies for the RA design and implementation that maximizes use of existing assets and interoperability, and ensures cost-effectiveness and long-term sustainability

Project Title:

Integration of Coastal Observations and Assets in the Carolinas in Support of Regional Coastal Ocean Observation System Development in the Southeast Atlantic

Recipient/ Lead Principal Investigator:

University of North Carolina Wilmington/ Dr. Lynn Leonard (*lynnl@uncw.edu*)

Cost:

Funded: FY 2007 (Year 1) - \$1,200,000
 FY 2008 (Year 2) - \$1,200,000
 FY 2009 (Year 3) - \$1,200,000

Performance:

The over-arching goal of this project is to integrate existing assets and observations in the North Carolina and South Carolina coastal region to create an end-to-end, proto-type regional coastal ocean observing system (RCOOS). This RCOOS will provide an instrumented test-bed, integrated through sophisticated data management protocols, that supports development of coastal process models, surf zone hazards (including rip-current) forecasts, and water quality products and services. Project objectives are to: 1) maintain and enhance observing assets; 2) support data analysis and modeling for U.S. Army Corps of Engineers (USACE) Coastal Process Model skill assessments; 3) support data analysis and modeling for National Weather Service nearshore forecasting; 4) ensure delivery of high-quality, DMAC-compliant data and products in a timely fashion, and; 6) engage regional partners, stakeholders and end-users in implementation and operation of a sustainable RCOOS and ensure coordination with SECOORA and IOOS. Since most of the data collection infrastructure is in place, this project is immediately executable and creates a test bed to evaluate observing system design criteria, such as the ability of a system to directly support specific user-driven application needs, as put forth by SECOORA.

Schedule:

1. Years 1-3
 - Maintain inner-shelf and nearshore monitoring stations in North and South Carolina coastal waters
 - Provide operational data streams for existing USACE stations
 - Develop prototype Surf Conditions Nowcasting System (SCNS)
2. Year 2
 - Develop prototype validations module linkage to RCOOS archive
 - Develop prototype interface with the USACE Model Evaluation and Diagnostics System (MEDS)
 - Migrate website components to appropriate (e.g. SECOORA) platform
3. Years 2-3
 - Upgrade NERR stations in North and South Carolina to real time
 - Build a comprehensive database including archived data from previous NOAA-funded programs in the Carolinas, USACE, and various water quality programs
 - Optimize and ensure access to near-real-time, delayed mode, and model output data via web
 - Develop rigorous procedures for assessment of real-time data and relay information to users

- Integrate standards and processes with other SECOORA data management activities
- Assess system function
- Conduct public outreach and stakeholder engagement for both the Carolinas RCOOS and SECOORA

4. Year 3

- Assess, assimilate and disseminate water quality information in North and South Carolina
- Upgrade systems that have surpassed expected lifecycle
- Demonstrate RCOOS-wide wave/current validation
- Deliver semi-operational RCOOS-wide validation module
- Evaluate Simulated Wave NearShore (SWAN) model as an approach to forecast wave conditions in Long Bay
- Document procedures for real-time data assessment and relay information to users
- Verify model improvement
- Develop standards-based visualization tools for SECOORA

Project Title:

A Regional Storm Surge and Inundation Model Test Bed for the Southeast Coastal Ocean Observing System Regional Association

Recipient/ Lead Principal Investigator:

University of Florida/ Dr. Peter Sheng (*pete@coastal.ufl.edu*)

Cost:

Funded: FY 2007 (Year 1) - \$500,000
FY 2008 (Year 2) - \$372,200
FY 2009 (Year 3) - \$372,200

Performance:

Using a community-based approach and working with the National Weather Service (NWS), Federal Emergency Management Agency (FEMA), and state and county departments of Emergency Management, this project will conduct a comprehensive validation and comparative study of four leading storm surge and inundation models developed by the academic community. The goals of this project are to enhance the storm surge and inundation modeling capabilities; establish common standards for storm surge and inundation modeling; bridge the gap between leading academic storm surge modelers and the operational agencies, and; potentially improve maps of inundation, e.g. the SLOSH surge atlas and Flood Insurance Rate Maps (FIRMs), for enhanced emergency planning and management.

Schedule:

1. Year 1

- Establish a panel of experts and users to produce a set of objective protocols and criteria for model-data and model-model comparisons
- Produce an updated inventory of storm surge, wave, and inundation modeling activities
- Identify the major products (e.g., SLOSH surge atlas, FIRMs, and inundation maps) produced by NWS and FEMA and used by Emergency Managers and determine possible enhancements
- Develop a common data framework and design realistic test problems with archived field and analytic data for model-data comparison and inter-comparison of storm surge and inundation models while leveraging current advances in DMAC and Marine Metadata Interoperability

- Develop a set of common model quality and performance standards for all surge, wave, and inundation models to be used in the region
 - Select past hurricanes for model validation and inter-comparison, gather and store data in a Storm Archive, as part of a virtual computing “Grid” that will leverage and build upon a Virtual Grid
2. Year 2
- Conduct simulations of selected hurricanes
 - Compare model results to data and with each other in terms of a number of model variables and skill assessment methods and to determine if these models meet existing federal standards
 - Determine the sensitivity of models’ skills to model attributes, coefficients, and input data
 - Using the four storm surge models and the Sea, Lake and Overland Surges from Hurricanes (SLOSH) model, produce and compare a surge atlas for a coastal region, following the method used to produce SLOSH surge atlas
 - Determine the sensitivity of a surge atlas to various model attributes and input data and improve the storm surge and inundation models if necessary
 - Working with NWS and Emergency Managers, recommend ways to potentially enhance the SLOSH surge atlas or produce ensemble surge atlas
3. Years 2-3
- Maintain and enhance Virtual Grid
4. Year 3
- Provide the results from the four storm surge models to FEMA and produce FIRMs for inter-comparison and comparison with the FEMA FIRM
 - Identify the sensitivity of FIRMs to various model features and input data
 - Working with FEMA, identify ways to enhance their FIRMs
 - Continue monthly PI and bi-weekly technical team coordination
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Project Title:

A Prototype Operational Modeling System for Waves, Coastal Currents, Inundation, and Hydrologic Flooding for Eastern North Carolina

Recipient/ Lead Principal Investigator:

University of North Carolina at Chapel Hill/ Dr. Rick Luettich (*rick_luettich@unc.edu*)

Cost:

Funded: FY 2007 (Year 1) - \$499,991
FY 2008 (Year 2) - \$371,950
FY 2009 (Year 3) - \$371,950

Performance:

This project is developing a modular, integrated modeling system for 24/7/365 forecasts of waves, storm surge, inundation, coastal circulation, and hydrologic runoff for Eastern North Carolina, a region highly susceptible to catastrophic impacts of severe coastal weather and a companion capability to improve rip current forecasts. Model skill is continuously and automatically evaluated against available in-situ observations using AutoMEDS. The goal is to demonstrate relevance to regional stakeholders of an operational watershed-to-coastal ocean modeling system that provides: information on offshore and nearshore wave conditions; information to assess rip current threats; regional wave and current conditions in high traffic areas, such as tidal

inlets; nearshore currents for search and rescue operations, and; inundation data associated with coastal storm surge and hydrologic runoff. Information is currently provided to three regional National Weather Service Weather Forecast Offices and North Carolina emergency managers for application during moderate conditions and severe storms and for use in marine forecasts, search and rescue operations, decision-making by emergency managers, and the U.S. Army Corps of Engineers for evaluating near shore sediment transport budgets.

Schedule Major Components:

1. Year 1
 - Develop and refine model domains and associated databases
 - Implemented quasi-operational, 24/7/365 high-resolution uncoupled wave (SWAN) and current/surge (ADCIRC) models for North Carolina. Developed data streams to distribute output to WFOs via OPeNDAP server
 - Ingest regional IOOS observational data streams and implement AutoMEDS skill assessment scheme
 - Evaluate strategies for establishing boundary conditions at the dynamic interface between the hydrologic and coastal models; determine the type and spatial/temporal frequency of shared information
2. Years 1-3
 - Work with lifeguards in Kill Devil Hills, NC, to provide daily rip current surveys. Couple these with wave observations and bathymetry observations to develop better understanding of conditions leading to rip current formation
 - Conduct annual meetings with primary users (NWS WFOs) to document and discuss feedback on product value and provide tech transfer
3. Year 2
 - Evaluate model skill, including development of methodology for directional wave spectra
 - Implement coupled wave and current/surge models
 - Configure uncoupled wave model to run locally in 3 collaborating WFOs for ingest into AWIPs system
 - Evaluate coupled wave/surge modeling system vs. historical hurricanes
 - Develop methodology to blend 24/7/365 model runs with event-based tropical cyclone ensemble forcing
 - Implement initial coupling of hydrologic and coastal models in quasi-operational job stream
3. Year 3
 - Evaluate coupled modeling system against historical data (e.g., Hurricane Floyd)
 - Enhance coupled system based on knowledge gained from initial implementation
 - Continue evaluation of system wide real time model skill
 - Pursue distribution of data to alternate partners
 - Develop educational modules based on hazards models for implementation in undergraduate environmental sciences class

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